

SALCHA RIVER SALMON ESCAPEMENT STUDIES

1973

(From Yukon River Anadromous Fish Investigations)
Completion Report for July 1, 1973 to June 30, 1974

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Introduction

The Salcha River is the most important king and summer chum salmon spawning stream in the Tanana River drainage. In 1972 a preliminary study was initiated to determine the abundance and distribution of the king salmon spawning population in the river. The age, sex and size composition of the spawning population was determined and a potential tower and weir site was located.

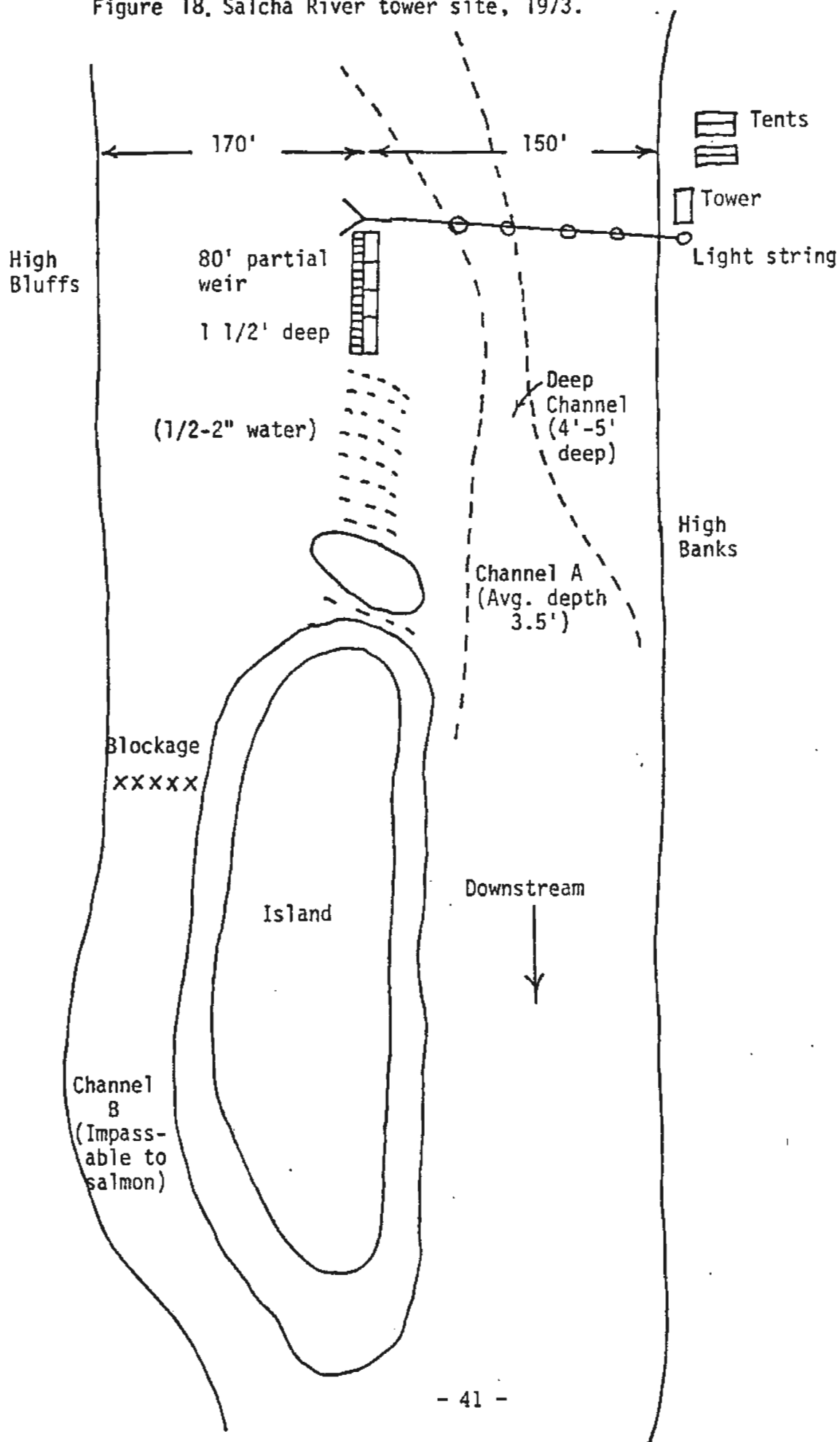
The announcement of plans to build the trans-Alaska hot oil pipeline across the Salcha River placed these studies in a high priority, due to the possibility of damage to the salmon stocks from construction activities associated with the buried pipeline or oil spills. If damage did occur, accurate data on population size and distribution would have to be available for mitigation and rehabilitation of the salmon runs.

In 1973 a comprehensive study was initiated on the Salcha River. The objectives of this study were to: (1) investigate the feasibility of using a counting tower to determine the daily and seasonal timing and magnitude of both the king and chum salmon runs, (2) evaluate aerial survey methods by comparing aerial counts to tower counts, (3) determine spawner distribution and major spawning areas in relation to the pipeline crossing, (4) determine the age, sex and size composition of the king and chum salmon escapement, (5) select a potential location for the operation of a salmon counting weir in the lower river, and (6) describe the physical, climatological and limnological characteristics of the Salcha River drainage.

Methods and Materials

A counting tower site was selected about 5 river miles above the Richardson Highway bridge (Figure 18). The river at this point was about

Figure 18. Salcha River tower site, 1973.



320 feet across. It consisted of two channels divided by a sandbar. One of the channels was very shallow and was not passable to salmon under normal water conditions. The second channel was partially weired off to reduce the counting area to about 150 feet. The average depth of this channel was approximately 3-1/2 feet. Large pieces of canvas were painted white, weighted with sandbags and dropped into the deepest part of the channel to improve visibility. A 22 foot prefabricated aluminum tower was erected on a 7 foot bank on the south side of the river (Figure 18).

A power line with four 300-watt incandescent light bulbs housed in 18-inch diameter reflectors was strung across the river to provide illumination during the hours of darkness. It was anchored to a large tree onshore and a tripod in the middle of the river. A 1500-watt generator provided electricity.

Each of the three crew members was scheduled to enumerate salmon for two 4-hour periods daily. Counts were recorded for hourly totals and the first 10 minutes of each hour. Salmon moving downstream were subtracted from the upstream total. Spawned-out salmon passing the tower were recorded, but not counted as moving downstream. The length of king salmon passing the tower was estimated by comparing them with models anchored to the river bottom. The lengths were > 50 mm (trout size), 50-60 mm (chum size), 60-80 mm (medium king) and < 80 mm (large king).

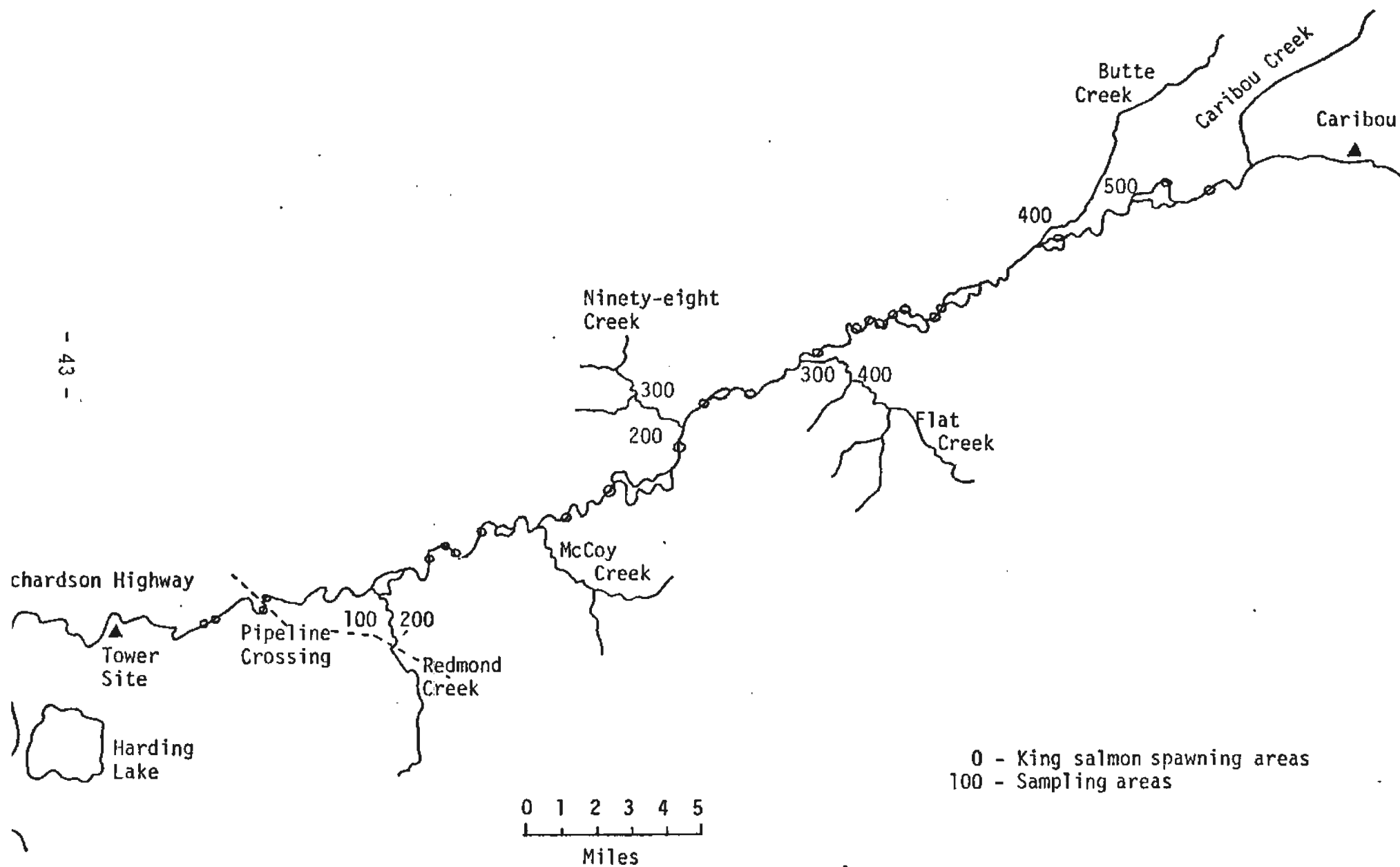
Two aerial surveys were made of the Salcha River near the peak of king salmon spawning. A Heliocourier aircraft was used on August 6 and a Bell Jet Ranger helicopter on August 7. The surveys covered the area between the river mouth and the North Fork of the Salcha.

A 24 foot outboard-jet powered riverboat was used to survey the 68 miles, where most of the spawning occurred, from the river mouth to Caribou Creek. King and chum salmon spawning areas were identified and plotted on a map.

Periodic carcass sampling and enumeration surveys were made by boat between August 1 and August 22. A scale smear was taken from each carcass examined and the length from mid-eye to fork of tail recorded. Spawning success was gauged by examining the gonads of carcasses. The location of all carcasses examined was recorded by sampling area (Figure 19).

Foot and boat surveys were made on the lower 1 to 1-1/2 miles of all the major tributaries of the Salcha. These surveys were made to obtain limnological data and to determine if king salmon fry and other species were using these streams for rearing areas. Water chemistry was determined with a Hach kit.

Figure 19. King salmon spawning areas, Salcha River, 1973.



Climatological data was recorded daily and limnological information periodically for the main river.

Results

The first adult king salmon was observed in the Salcha River on July 15. The water did not sufficiently clear to enumerate salmon from the tower, however, until July 18. After 35 hours of counting, a total of 48 king salmon and 6 chum salmon were enumerated past the tower. By 1100 hours on July 19, heavy rains and rising water conditions eliminated any possibility of further counts and this phase of the project was terminated.

Two hundred forty-nine king salmon and 290 chums were enumerated on the August 6 aerial survey and only 191 kings and 17 chums were enumerated on August 9 under poor survey conditions. Comparative aerial survey counts are presented in Appendix Tables 12 and 13.

The location of king salmon and chum salmon spawning areas is shown in Figure 19 and 20 only. Seventeen percent of the king salmon spawning areas and 10 percent of the chum spawning areas were located below Redmond Creek (vicinity of Pipeline Crossing).

King and chum salmon carcass distribution by area of river is presented in Tables 11 and 12. Eighty-two percent of the king carcasses were found below Ninety-eight Creek. The majority of the chum carcasses were found in four areas--Keopke Slough, near Butte Creek, 1/2 mile below Flat Creek and 2 miles above Ninety-eight Creek.

Based on 93 carcass samples, the 1973 Salcha River king salmon escapement was made up of 63 percent males and 37 percent females (Table 13). Ages 4_2 through 7_2 were represented with ages 5_2 , 6_2 and 7_2 composing 34 percent, 29 percent and 26 percent of the sample respectively. Examination of carcass gonads for post-spawning condition indicated that 93 percent of the male king salmon and 100 percent of the females were partially or completely spent (Table 14). An average of only 7.3 eggs was retained per female.

Based on 312 carcass samples, the 1973 Salcha River chum salmon escapement was composed of 45 percent males and 55 percent females (Table 15). Age class 3_1 to 5_1 were represented with age group 4_1 fish composing 76 percent of the sample. Eighty-three percent of the male chums and 91 percent of the female chums were partially or completely spent. An average of 242 eggs was retained per female chum (Table 14).

Figure 20. Chum salmon spawning areas, Salcha River, 1973.

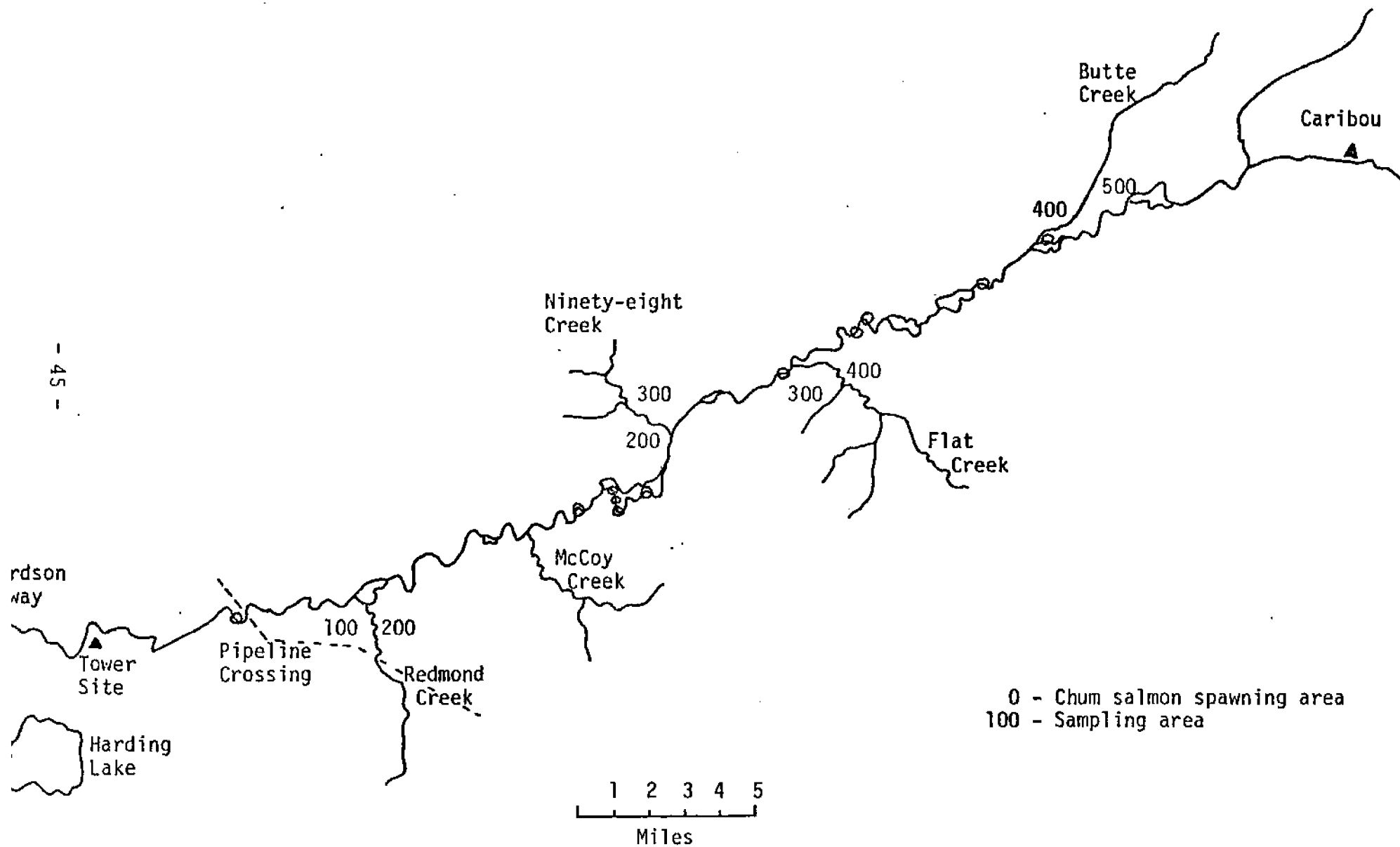


Table 11. King salmon abundance and distribution, Salcha River, 1973.

Area ^{1/}	Aerial Survey (8/6)		Carcass Survey (8/1-8/22)						Boat Survey (8/1-8/22)	
			Males		Females		Combined		Redds	
	Number	%	Number	%	Number	%	Number	%	Number	%
100	19 ^{2/}	8.0	36	51.0	9	21.0	45	40.0	4	17.0
200	59 ^{3/}	24.0	25	36.0	24	55.0	49	42.0	7	29.0
300	-	-	5	7.0	6	14.0	11	10.0	2	8.0
400	141 ^{4/}	56.0	2	3.0	2	5.0	4	4.0	7	29.0
500	30	12.0	2	3.0	2	5.0	4	4.0	4	17.0
TOTAL	249	100.0	70	100.0	43	100.0	113	100.0	24	100.0

- 1/ 100--River mouth to mouth of Redmond Creek.
 200--Mouth of Redmond Creek to mouth of Ninety-eight Creek.
 300--Mouth of Ninety-eight Creek to mouth of Flat Creek.
 400--Mouth of Flat Creek to mouth of Butte Creek.
 500--Mouth of Butte Creek to mouth of North Fork.
- 2/ To pipeline crossing two miles below Redmond Creek.
 3/ To McCoy Creek.
 4/ From McCoy Creek to Butte Creek

Table 12. Chum salmon abundance and distribution, Salcha River, 1973.

Area ^{1/}	Aerial Survey (8/6)		Carcass Survey (8/1-8/22)						Boat Survey (8/1-8/22)	
			Males		Females		Combined		Spawning Areas	
	Number	%	Number	%	Number	%	Number	%	Number	%
100	110 ^{2/}	38.0	9	6.0	9	5.0	18	5.0	1	10.0
200	79 ^{3/}	27.0	44	28.0	47	26.0	91	27.0	4	40.0
300	-	-	40	25.0	33	18.0	73	21.0	1	10.0
400	101 ^{4/}	35.0	39	24.0	52	28.0	91	27.0	3	30.0
500	-	-	27	17.0	41	23.0	68	20.0	1	10.0
TOTAL	290	100.0	159	100.0	182	100.0	341	100.0	10	100.0

1/ 100--River mouth to mouth of Redmond Creek

200--Mouth of Redmond Creek to mouth of Ninety-eight Creek.

300--Mouth of Ninety-eight Creek to mouth of Flat Creek.

400--Mouth of Flat Creek to Butte Creek.

500--Butte Creek to North Fork.

2/ To pipeline crossing two miles below Redmond Creek.

3/ To McCoy Creek.

4/ From McCoy Creek to Butte Creek.

Table 13. Age, sex and size composition of king salmon carcass sample, Salcha River, 1973.

	4 ₂	5 ₂	6 ₂	7 ₂	Total
Males					
Number	10	29	11	8	58
Percent	11.0	31.0	12.0	9.0	63.0
Mean length (mm) ^{1/}	680	740	920	980	800
Females					
Number	-	3	16	16	35
Percent	-	3.0	17.0	17.0	37.0
Mean length (mm)	-	810	900	960	919
Combined sexes					
Number	10	32	27	24	93
Percent	11.0	34.0	29.0	26.0	100.0
Mean length (mm)	680	746	908	970	843

^{1/} All lengths are from center of eye to fork of tail.

Table 14. Post spawning condition of Salcha River salmon carcasses, 1973.

KING SALMON

Males

Females

Date of Survey	Survey No.	Spawned Out	Partially Spent	Did Not Spawn	Total	Spawned Out	Did Not Spawn	Partially Spent	Average No. of Eggs Retained Per Female	Total
(8/1-8/5)	1	9 (13.0%)	1 (1.0%)	-	10 (15.0%)	3 (7.0%)	-	1 (2.0%)	2.0	4 (9.0%)
(8/7-8/10)	2	13 (19.0%)	17 (25.0%)	4 (6.0%)	34 (50.0%)	7 (16.0%)	-	2 (4.5%)	20.0	9 (21.0%)
(8/13-8/16)	3	9 (13.0%)	8 (12.0%)	-	17 (25.0%)	15 (34.0%)	-	1 (2.0%)	.7	16 (36.0%)
(8/18-8/22)	4	2 (3.0%)	4 (6.0%)	1 (1.0%)	7 (10.0%)	13 (30.0%)	-	2 (4.5%)	5.0	15 (34.0%)
Combined Surveys		33 (49.0%)	30 (44.0%)	5 (7.0%)	68 (100.0%)	38 (87.0%)	-	6 (13.0%)	7.3	44 (100.0%)

CHUM SALMON

Males

Females

Date of Survey	Survey No.	Spawned Out	Partially Spent	Did Not Spawn	Total	Spawned Out	Did Not Spawn	Partially Spent	Average No. of Eggs Retained Per Female	Total
-	1	-	-	-	-	-	-	-	-	-
(8/7-8/10)	2	3 (2.0%)	30 (18.0%)	5 (3.0%)	38 (23.0%)	29 (17.0%)	1 (.5%)	12 (7.0%)	77.0	42 (24.0%)
(8/13-8/16)	3	1 (1.0%)	4 (2.0%)	10 (6.0%)	15 (9.0%)	6 (3.0%)	5 (3.0%)	2 (1.0%)	969.0	13 (8.0%)
(8/18-8/22)	4	35 (21.0%)	63 (39.0%)	13 (8.0%)	111 (68.0%)	85 (49.0%)	10 (5.5%)	24 (14.0%)	221.0	119 (68.0%)
Combined Surveys		39 (24.0%)	97 (59.0%)	28 (17.0%)	164 (100.0%)	120 (69.0%)	16 (9.0%)	38 (22.0%)	242.0	174 (100.0%)

Table 15. Age, sex, and size composition of chum salmon carcass sample,
Salcha River, 1973.

	3 ₁	4 ₁	5 ₁	Totals
Males				
Number	13	111	17	141
Percent	4.0	36.0	5.0	45.0
Mean length (mm) ^{1/}	580	600	630	602
Females				
Number	20	129	22	171
Percent	6.0	42.0	7.0	55.0
Mean length (mm)	560	590	580	585
Combined sexes				
Number	33	240	39	312
Percent	11.0	76.0	13	100.0
Mean length (mm)	570	590	600	592

^{1/} All lengths are from center of eye to fork of tail.

Out of five major tributaries surveyed, four were found to contain king salmon fry (Appendix Table 15). Limnological and physical data for all major tributaries and the main river are presented in Appendix Table 14 and 15.

No suitable weir site was located in the lower 15 miles of the Salcha River.

Discussion

It is probably not feasible to successfully enumerate salmon from a counting tower in the lower Salcha River more often than one year out of four. The size of the lower river, combined with rapidly fluctuating water levels, is the primary problem. At the 1973 tower site, which was the optimum location on the lower river, the river was approximately 320' across with an average depth of 3.5 feet. Even at low water levels, it was difficult to see salmon in the deepest part of the channel. Brown stained water and frequent floods complicated the problem.

The August 6, 1973 aerial survey estimate of 249 adult king salmon was the second poorest count on record. It is only 21 percent of the 1972 aerial survey estimate of 1,193 king salmon (Lebida, 1972). Based on aerial survey estimates and boat surveys of the entire spawning area of the river, the 1973 escapement level was very low. It is felt that this poor escapement is the direct result of the severe flooding which occurred during the peak of spawning in August, 1967. The age composition of the 1973 king salmon run supports this. The 6₂ age group, which normally comprises the largest portion of the escapement, represented only 29 percent of the escapement in 1973. Age group 6₂ comprised 82 percent of the 1972 Salcha River carcass sample (A-Y-K Data Report, 1972). The age class 5₂ and 7₂ fish, which normally comprises less than 30 percent of the total catch sample in the Yukon River commercial catch sample, made up 60 percent of the Salcha River carcass sample in 1973. Assuming normal survival and age composition of the run, the Salcha will probably experience another poor escapement in 1979.

The August 6, 1973 aerial survey escapement estimate of 290 chums is only 30 percent of the 1972 estimate of 947 chums. However, the aerial survey data is not complete since 312 carcasses were examined on carcass surveys alone. The reason for this is that the aerial survey was flown before the peak of chum spawning which probably occurred in mid-August. A gross estimate of chum salmon escapement based on boat survey data and personal observations would be from 900-1,500 spawning chum salmon. This figure is below the average of 11 years of aerial survey estimates.

Due to chronic problems with the outboard jet units during the boat surveys and the tendency for spawned-out king salmon to drift long distances from the redd before dying, it is felt that the August 6 aerial survey was the best indicator of king salmon abundance and distribution in 1973. Based on the aerial survey estimates, 8 percent of the king salmon in the Salcha River drainage spawn below the trans-Alaska main river pipeline crossing and 32 percent below Redmond and McCoy creeks (Table 11). Redmond and McCoy creeks are important tributaries of the Salcha River, which enter the Salcha upstream from the pipeline crossing. In addition, both of these streams will be crossed by the pipeline above their confluence with the Salcha, and could convey oil into the Salcha in the event of an oil spill. The area affected by an oil spill could extend from the mouth of McCoy or Redmond Creek to the mouth of the Salcha. The 1973 aerial survey estimates agree very closely with the 1972 aerial survey estimates of 12 percent of the king salmon spawning below the main river pipeline crossing and 30 percent below McCoy Creek (Lebida, 1972).

The August 6, 1973 aerial survey indicated that 38 percent of the chums observed were below the pipeline crossing and 65 percent were below McCoy Creek. These were migrating fish, however, and the actual percentage of the total escapement was closer to 10 percent spawning below the main river pipeline crossing and 20 percent below McCoy Creek. This is based on observations of spawning chums made on the boat surveys (Table 12). No data on chum salmon distribution in the Salcha was available from 1972.

The age and sex composition of the 1973 Salcha River king salmon escapement sample was significantly different from the age and sex composition of the 1973 Emmonak commercial catch sample taken near the mouth of the Yukon River (Appendix Table 16). The Emmonak sample was composed of 53 percent male king salmon and 76 percent age class 6₂ king salmon. The Salcha sample was composed of 63 percent males and age class 6₂ only comprised 29 percent of the total sample. This difference in age and sex composition can be accounted for by the poor return of the 6₂ age class, which normally contains the largest percentage of female king salmon in the sample.

There was no significant difference between the age and sex composition of the Salcha River chum salmon escapement sample and the Emmonak commercial catch sample which was composed of 43 percent males and 65 percent age class 4₁ chum salmon (Regnart et al, 1973). This may indicate that the commercial fishery, which is known to be selective for the larger male chum salmon, did not have a significant effect on the age and sex composition of the chum run in 1973.

The presence of king salmon fry in Salcha River feeder streams had not been reported previously. Their presence indicates that they actively

migrate into areas where no adults have ever been observed spawning. In two cases (Flat Creek and Redmond Creek) fry were captured several miles upstream from the main river. To reach these areas, the fry had to negotiate a very swift current. Their presence in these streams is very important in the light of plans for developing this area. Precautions will have to be taken to ensure the quality of these streams as rearing areas is preserved. Culvert size and stream modifications will have to be designed to allow passage of fry at all water levels.

Observations made during the 1973 field season indicate that it is probably not feasible to build a weir across the lower Salcha River with the resources currently available to the Yukon research staff. The lower Salcha is too wide, too swift and too deep to weir with any structure which could be erected without the use of heavy equipment. During the months of July and August heavy rains caused frequent periods of high water accompanied by logs, trees and debris. A conventional weir would have to be removed several times during a field season to avoid being washed out under these conditions.

Summary

1. The physical size of the lower Salcha River, the brown stained water and frequent periods of high water would make it impossible to successfully enumerate salmon from a counting tower in most years.
2. Two hundred forty-nine king salmon and 290 chums were enumerated on the August 6 aerial survey of the Salcha River.
3. Seventeen percent of the king salmon redds and 10 percent of the total chum salmon spawning areas were located below Redmond Creek.
4. Eighty-two percent of the king salmon carcasses were found below Ninety-eight Creek. Chum carcasses were found in four areas; Keopke Slough, Butte Creek, 1/2 mile below Flat Creek and two miles above Ninety-eight Creek.
5. The 1973 king salmon carcass sample was composed of 63 percent males. Ages 3₂ through 7₂ were represented, with ages 5₂, 6₂ and 7₂ comprising 34 percent, 29 percent and 26 percent of the sample.
6. The 1973 chum salmon carcass sample was made up of 45

percent males and 55 percent females. Age classes 3₁ to 5₁ were represented with age group 4₁ fish composing 77 percent of the sample.

7. Four of the five major tributaries of the Salcha River contained king salmon fry.
8. No suitable weir site was located on the lower Salcha River in 1973.